

REMARKS

This paper is in response to the Advisory Action mailed December 20, 2005. By this paper, claims 1, 6 and 14 are amended and claim 13 is cancelled. Therefore, claims 1-12 and 14-16 are pending upon entry of this paper.

Applicant thanks the Examiner for conducting a telephone interview with Applicant's attorney on January 4, 2006. During the interview, the Katsume et al. reference (U.S. Patent No. 5,292,122) and Applicant's previously submitted response to the Final Office Action were discussed. It was agreed that independent claim 15 is patentable over the cited prior art and that independent claim 1 would also be allowable if the limitation found in dependent claim 13 were to be incorporated therein. Claim 1 has been so amended and claim 13 cancelled. Therefore, claim 1 is believed to now be in proper condition for allowance. No agreement was reached regarding the patentability of claim 6.

Claim 1 requires the step of forming a cloud of thermalized sputtered particles. The thermalization occurs when the gas density in the transport region is high enough to provide intense elastic collisions between sputtered particles and atoms of residual gas. This is achieved by increasing the gas pressure so that the mean free path of elastic collisions becomes small relative to length of transport region, providing intensive kinetic energy and momentum exchange between sputtered particles and atoms of the residual gas. These collisions create the isotropy in sputtered particle momentum and reduce its kinetic energy to a "cold" level. The thermalization reduces the energy brought by depositing particles to the film.

Katsume et al. does not form a cloud of sputtered particles. In fact, Katsume et al. teach away from the establishing the conditions that cause the formation of a cloud. As pointed out in the declaration submitted under 37 C.F.R § 1.132 with Applicant's response to the Final Office Action, a relatively low residual gas pressure (density) of 3×10^{-5} Torr (Katsume et al., Embodiment 1) to 2×10^{-4} Torr (Katsume et al., Experiment 4) with mean free path of elastic collisions in the range of tens of centimeters and extremely low sputter/deposition rate do not provide conditions for formation of a sputter particle cloud. At this gas pressure, the particles emitted by the target would reach the substrate practically without collision. For this reason, these sputtered particles bring their original kinetic energy of several eV to the film. This energy is much higher than the energy of thermalized

sputter particles. This seems to be a possible reason why the growing films in the apparatus depicted in the Katsume et al. reference require cooling in spite of an almost negligible deposition rate (Fig. 8). Thus, the formation of a cloud as required by claim 1 is not inherent in the operation of the Katsume et al apparatus.

Accordingly, claim 1 is patentable over the cited references. Claim 15 contains limitations similar to the one described above. Therefore, claim 15 is patentable for at least the same reason. Claims 2-5, 10-13 and 16, depending directly or indirectly from one of claim 1 or 15 are patentable over the cited references for at least the same reasons.

Response to Rejection of Claim 6

Claim 6 is directed to a physical vapor deposition (PVD) system for deposition of dielectric materials, including low dielectric constant (low-k) materials, onto substrates during the fabrication of integrated circuits and other electronic, opto-electronic, microwave, and micro electro-mechanical (MEM) devices. More particularly, claim 6, is directed to a system for the physical vapor deposition (PVD) of dielectric material onto a substrate comprising, *inter alia*:

means for forming a thermalized cloud of said sputtered particles proximate
said substrate;

Claim 6 in the application stands rejected as being obvious in view of Katsume et al. in view of the non-patented art of Shimokawa (hereinafter “Shimokawa”). Claim 6 is novel and patentable over the references of record, and particularly over Katsume et al. and Shimokawa, because the cited art does not show or suggest a system for the physical vapor deposition (PVD) of dielectric material onto a substrate comprising means for forming a thermalized cloud of said sputtered particles proximate said substrate as required by claim 6.

In paragraph 15 of the Final Office Action, the Examiner states that Katsume et al. teach the limitations of claim 6 with the exception of the specifics of the ion/neutral beam source. However, as set forth above, the sputtered particles in the Katsume et al. reference are not thermalized. Therefore, Katsume et al. do not teach or suggest a means for forming a thermalized cloud as required

by claim 6. Shimokawa discloses a new high-power fast atom beam source. Shimokawa also does not teach or suggest the formation of a thermalized cloud of sputtered particles. Therefore, Shimokawa cannot cure the deficiencies of Katsube et al.

Accordingly, claim 6 is not anticipated by or made obvious by the cited reference and favorable consideration of claim 6 is respectfully requested. Claims 7-9, depending directly or indirectly from claim 6, are submitted as patentable over the cited references for at least the same reasons.

Conclusion

In view of the remarks made herein, Applicant submits that the claims presented herein are patentably distinguishable from the art applied and prompt allowance of the application is respectfully requested.

Should the Examiner determine that anything else is desirable to place this application in even better form for allowance, the Examiner is respectfully requested to contact the undersigned by telephone.

Respectfully submitted,
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January 6, 2006